Paramagnetic Fluorinated Nanoemulsions for in vivo F-19 MRI.

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Public Summary:
PURPOSE: We aim to develop perfluorocarbon-based nanoemulsions with improved sensitivity for detection of inflammatory macrophages in situ using F-19 MRI. Towards this goal, we evaluate the feasibility of nanoemulsion formulation incorporating a metal chelate in the fluorous phase which shortens the F-19 longitudinal relaxation rate and image acquisition time.

Scientific Abstract:
PURPOSE: We aim to develop perfluorocarbon-based nanoemulsions with improved sensitivity for detection of inflammatory macrophages in situ using F-19 MRI. Towards this goal, we evaluate the feasibility of nanoemulsion formulation incorporating a metal chelate in the fluorous phase which shortens the F-19 longitudinal relaxation rate and image acquisition time. PROCEDURES: Perfluorinated linear polymers were conjugated to metal-binding tris-diketonate, blended with unconjugated polymers, and emulsified in water. Phospholipid-based surfactant was used to stabilize nanoemulsion and provide biocompatibility. Nanoemulsions were metalated with the addition of ferric salt to the buffer. Physical stability of surfactant and nanoemulsion was evaluated by mass spectrometry and dynamic light scattering measurements. Nanoemulsions were injected intravenously into a murine granuloma inflammation model, and in vivo$(19)F/(1)H$ MRI at 11.7 T was performed. RESULTS: We demonstrated stability and biocompatibility of lipid-based paramagnetic nanoemulsions. We investigated potential oxidation of lipid in the presence of metal chelate. As a proof of concept, we performed non-invasive monitoring of macrophage burden in a murine inflammation model following intravenous injection of nanoemulsion using in vivo F-19 MRI. CONCLUSION: Lipid-based nanoemulsion probes of perfluorocarbon synthesized with iron-binding fluorinated beta-diketones can be formulated for intravenous delivery and inflammation detection in vivo.

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